THE APPLICATION OF PROBLEM-BASED LEARNING (PBL) TO IMPROVE THE COMMUNICATION MATHEMATICS SKILLS OF STUDENTS GRADE VII

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ABSTRACT

Mathematics lessons involving students are suspected as one of the causes of the lack of students' mathematical communication skills. The researcher aims to improve the skills of nonverbal communication mathematics students of class VII B State Junior High School 9 Yogyakarta (SMP Negeri 9 Yogyakarta) by implementing Problem Based Learning (PBL). The type of this research is Classroom Action Research (CAR). The subject of this research is the students of class VII B SMP Negeri 9 Yogyakarta academic year 2016/2017 with the number of students 34 people. At the same time, the object in this research is the whole process of applying Problem Based Learning (PBL). Data collection techniques are done through observation techniques, interviews, and documentation. The Instrument of data collection in the form of observation sheet, the result of the problem-solving of nonverbal communication skills of student mathematics, and the result of the interview. The subject of this research is a student of class VII B SMP Negeri 9 Yogyakarta academic year 2016/2017 with student number 34 people. At the same time, the object in this research is the whole process of applying Problem Based Learning (PBL). Data collection techniques are done through observation techniques, interviews, and documentation. The Instrument of data collection in the form of the observation sheet results in the completion of the problem of nonverbal communication skill exercise of student mathematics and interview result. The results of this research show that applying Problem Based Learning (PBL) can improve students' mathematical nonverbal communication skills. The improvement of students' mathematical nonverbal communication skills is derived from the average score of significant exercise improvement with the percentage of 65,32% in cycle I increased to a very high category with 86,90% percentage in cycle II.

Keywords: Improve, Nonverbal Communication Skills, PBL

INTRODUCTION

Education as mentioned in Law Number 20 of 2003 concerning the National Education System Chapter 1 Article 1: Education is a conscious and planned effort to create an atmosphere of learning and learning process so that students actively develop their potential to have religious-spiritual abilities, self-control, personality, intelligence, noble character, and skills needed by himself, society, nation, and state. Based on the understanding of education, as mentioned above, education is an effort to create an atmosphere of learning and learning process. According to Article 1, Paragraph 20 of the Law, learning is the process of interaction of students with educators and learning resources in a learning environment. Based on this understanding of learning, learning is the main process organized by the school so that the teacher who teaches can help students to receive the knowledge provided and facilitate the achievement of learning objectives.

One of the subjects at school is in Mathematics. Johnson and Myklebust, 1967 in Mulyono Abdurrahman (2003: 525) stated that Mathematics is a symbolic language whose practical function is to express quantitative relations and spaces. The logical function is to facilitate thinking. Based on these mathematical functions, mathematics is a structured science that arises because human thoughts are directly related to ideas, processes, and reasoning. Therefore, learning mathematics is developed to train students in problem-solving and communicating ideas not only through verbal or direct interaction and other media such as symbols, tables, but the other is also nonverbal communication.

As mentioned by Julia T. Wood ((2003: 3), communication (communication) is a systematic process where people interact with and through symbols to create and interpret meanings. According to the Indonesian Big Dictionary, Nonverbal communication is not in conversation, not in language. A person is said to be able to communicate well not only because he can absorb information that is heard and seen but also to present what he understands through pictures, writing, or verbal communication. Because mathematics is a science related to thinking and the results of thinking (ideas), there needs to be a way to present the results of that thinking. Communication is an appropriate way to convey ideas and clarify students' understanding of concepts.

In this study, the model used to improve mathematical communication skills is the problem-based learning (PBL) learning model. According to Uden & Beaumont, 2006 in Jamil Suprihatiningrum (2013: 222) states Some of the advantages that can be observed from students who learn by using the Problem Based Learning (PBL) approach, namely:

1. Can better remember information and knowledge.
2. Developing problem-solving skills, critical thinking, and communication skills.
3. Develop a knowledge base in an integrated manner.
4. Enjoy learning.
5. Increase motivation.
6. Good at group work.
7. Develop learning strategies.
8. Improve communication skills.

Learning using the Problem Based Learning (PBL) learning model is carried out with the provision of problems that are then carried out problem-solving by students, which are expected to increase students' communication skills in achieving learning material.

Based on an interview with Mrs. Sri Sudarini, a grade VII mathematics teacher at SMP Negeri 9 Yogyakarta on October 27, 2016, mathematics learning that did not involve students was suspected to be one of the causes of students' lack of nonverbal mathematical communication skills, so students tended to depend on teachers to obtain learning concepts, from on learning and finding their solutions. Hence, students have difficulty changing story problems into mathematical models (such as drawing or mathematical sentences). Students tend to lack confidence in conveying mathematical ideas in writing so that students have difficulty writing the conclusions of a given solution, besides the ability of students to use terms, and mathematical notations are still low. Therefore, the majority of students' mathematics grades under the Minimum Completeness Criteria (MCC) are shown in Table 1 below:

Table 1. Mid-semester assessment of class VII Even semester of SMP N 9 Yogyakarta in 2016/2017 Academic Year

Class	≥ MCC (75)	< MCC (75)	Student Number
VII A	3	31	34
VII B	11	23	34
VII C	4	30	34
VII D	5	29	34
VII E	8	26	34
VII F	3	31	34

Source: SMP Negeri 9 Yogyakarta 2016/2017

Based on the description above, the authors intend to research the title The Implementation of Problem Based Learning (PBL) to Improve Mathematical Communication Skills of Grade VII Students of SMP Negeri 9 Yogyakarta 2016/2017 Academic Year. This study aims to improve the nonverbal mathematical communication skills of students of SMP Negeri 9 Yogyakarta through the application of Problem Based Learning (PBL) on triangular, square, and rectangular material.

METHODS

This research is classified as class action research. The research was conducted at SMP Negeri 9 Yogyakarta. At the same time, the research time is even a semester of the 2016/2017 school year. This research will involve mathematics teachers, researchers, and students of class VII B of SMP Negeri 9 Yogyakarta. This class action research is planned in two cycles. The first cycle is carried out by a plan that has been prepared by the researcher. The second cycle is intended as an improvement from the first cycle, and each learning meeting is given a matter of practice.

Data collection techniques are used with observation techniques to analyze and record systematically about students' nonverbal mathematical communication skills by applying Problem Based Learning (PBL). The recording is carried out by two observers of events at the time the action is carried out. Interview technique was conducted to find out the improvement of students' nonverbal mathematical communication skills and the factors causing low nonverbal mathematics communication skills of students so that they could make improvements to mathematics learning by applying Problem Based Learning (PBL). Field notes are used to determine the state of students and teachers when the learning process takes place. Field notes contain class learning, classroom atmosphere, classroom management, teacher interaction with students, and other aspects that need to be noted. The practice questions for students' nonverbal mathematical communication skills for this Instrument contain questions that are arranged based on aspects and indicators of students' nonverbal mathematical communication skills that have been determined by researchers that function to measure students' communication skills and are aimed at each student while learning takes place.

RESULTS AND DISCUSSION

Research carried out in 2 cycles, and each cycle includes planning, action, observation and evaluation, and reflection.

1. Cycle I

From observations at this first meeting, some students began to show enthusiasm for learning mathematics even though it was their first meeting and meeting face to face. When the researcher starts the lesson and starts with an introduction and continues to start with the learning material that is appreciated and connects the material with everyday life like a triangle around the class, after that, the researchers divided students into several groups (groups with their peers) and explained the learning model that would be carried out during the learning process. After that, the researcher gave material about triangles, there were still many students who did not pay attention to the researchers, students were busy with their peers, and some were lazy. However, after being warned by researchers, the atmosphere of the classroom calmed down.

After completing the learning material and examples of researchers shared the practice questions one cycle I to do with a classmate. The class atmosphere became lively again because some students asked questions before they were understood. The researcher reprimands and explains the steps to complete the exercise. After that, students begin to work. In doing the first cycle one practice questions, some students still did not dare to ask questions, so the students did the practice questions with their understanding. Some students only chat with their peers. The lack of mastery of the material students does the training questions in modest without paying attention to the information and commands that are in the problem. The results of the exercise shown from the results of the exercise 1 cycle I can be seen in the following table 2.

Table 2. Analysis of Results of Communication Skills Training Nonverbal Mathematics of Class VII B Students in Cycle I Meeting 1

Aspect	Indicator	Score per Indicator	Percentage	Category	Scores per Aspect	Percentage	Average	Category
Cognitive	Students convert the story questions into mathematical models in writing answers (such as pictures or mathematical sentences).	40	39,21	Low	142	46,4	56,93	Moderate
	Students write the answer by describing the process systematically.	57	55,88	Low				
	Students can express mathematical ideas in writing and demonstrate and illustrate them visually.	45	44,11	Low				
Heterosexual	On the worksheet, students can understand, interpret, and evaluate mathematical ideas in writing.	60	58,82	Moderate	100	49,01		
	Students write the conclusions of the solution given (e.g., writing so, ...).	40	39,21	Low				
Control	The ability to use terms, mathematical notations, and structures to present ideas describes relationships with situation models.	74	72,54	High	74	72,54		
Perception	Students can associate and apply other materials to solve problems.	61	59,80	Moderate	61	59,80		

At this second meeting, the researcher also gave two cycles. I practice questions like the first meeting. At the time of work on the exercise questions, the teacher surrounded the class and invited students to ask questions when facing difficulties. However, some students do not dare to ask questions, so students work on practice questions with their understanding. Some students only chat with their peers, the lack of mastery of the material students do the training questions in modest without paying attention to the information and commands that are in the problem. The results of the exercise can be seen in the following table 3:

Table 3. Analysis of the Results of Nonverbal Mathematical Communication Skills Training Class VII B Students at Cycle I Meeting 2

Aspect	Indicator	Score per Indicator	Percentage	Category	Scores per Aspect	Percentage	Average	Category
Cognitive	Students convert the story questions into mathematical models in writing answers (such as pictures or mathematical sentences).	88	86,27	High	231	75,48	82,59	High
	Students write the answer by describing the process systematically.	53	51,96	Low				
	Students can express mathematical ideas in writing and demonstrate and illustrate them visually.	90	88,23	High				
Heterosexual	On the worksheet, students can understand, interpret, and evaluate mathematical ideas in writing.	99	97,05	Very High	130	63.72		
	Students write the conclusions of the solution given (e.g., writing so, ...).	31	30,39	low				
Control	The ability to use terms, mathematical notations, and structures to present ideas, describe relationships with situation models.	96	94,11	Very High i	96	94,11		
Perception	Students can associate and apply other materials to solve problems.	99	97,05	Very High	99	97,05		

Based on the reflection done by researchers and mathematics teachers, it is stated that by learning to use the application of Problem Based Learning (PBL), the following are obtained:

1. Some students are still incapable of turning questions into mathematical models.
2. Some students just write a mathematical problem solving briefly without knowing the solution process.
3. Some students are still not able to convey mathematical ideas in writing with pictures.
4. Some students are still not accustomed to writing information about questions before working on it.
5. There are still many students who have not been accustomed to writing conclusions from the solutions given.
6. Some students are still unable to provide answers using mathematical notations.
7. Some students have not been able to link the material in completing the given exercise.

2) Cycle II

From observations at the first meeting of the second cycle, students already feel confident in conveying ideas when learning takes place. Students look enthusiastic when researchers open their learning. Continue to start with the learning material that is appreciated and connect the material with daily life like triangles around the class. After that, the researcher divided students into several groups (groups with each seatmate) and explain the learning model that will be carried out during learning takes place as the previous meeting in cycle I. After that, the researcher gives material about

triangles and is given an exercise 1 cycle II. Each group begins to do the first cycle 1 exercise given. The students can complete the problem in the exercise. Students begin to describe the work process in detail and conclude the end of the work. The results of mathematics communication skills training students can be seen in the following table 4:

Table 4. Analysis of Results of Students' Mathematical Communication Skills Training in the Form of Nonverbal Communication of Class VII B Students at Cycle 1 Meeting II

Aspect	Indikator	Score per Indicator	Percentage	Category	Scores per Aspect	Percentage	Average	Category
Cognitive	Students convert the story questions into mathematical models in writing answers (such as pictures or mathematical sentences).	100	98,04	Low	267	87,25	91,66	Very high
	Students write the answer by describing the process systematically.	68	66,67	Low				
	Students can express mathematical ideas in writing and demonstrate and illustrate them visually.	99	97,05	Low				
Heterosexual	On the worksheet, students can understand, interpret, and evaluate mathematical ideas in writing.	102	100	Moderate	162	79,41		
	Students write the conclusions of the solution given (e.g., writing so, ...).	60	58,82	Low				
Control	The ability to use terms, mathematical notations, and structures to present ideas, describe relationships with situation models.	102	100	High	102	100		
Perception	Students can associate and apply other materials to solve problems.	102	100	Moderate	102	100		

At this second meeting, researchers also gave exercise questions two as the first meeting. Students are already familiar with story problems so students can change story questions into mathematical form, describe, work on gradually, and conclude the final results of the questions. The results of mathematics communication skills training students can be seen in the following table 5:

Table 5. Analysis of the Results of Nonverbal Mathematical Communication Skills of Class VII B Students at Cycle 2 Meeting II

Aspect	Indikator	Score per Indicator	Percentage	Category	Scores per Aspect	Percentage	Average	Category
Cognitive	Students convert the story questions into mathematical models in writing answers (such as pictures or mathematical sentences).	102	100	Very high	306	100	95,58	Very high
	Students write the answer by describing the process systematically.	102	100	Very high				
	Students can express mathematical ideas in writing and demonstrate and illustrate them visually.	102	100	Very high				
Heterosexual	On the worksheet, students can understand, interpret, and evaluate mathematical ideas in writing.	102	100	Very high	168	82,35		
	Students write the conclusions of the solution given (e.g., writing so, ...).	66	64,70	Very high				
Control	The ability to use terms, mathematical notations, and structures to present ideas, describe relationships with situation models.	102	100	Very high	102	100		
Perception	Students can associate and apply other materials to solve problems.	102	100	Very high	102	100		

After carrying out the second cycle, researchers do a reflection on the learning that has been done. Based on the reflections that have been made between researchers, teachers, and fellow observers, it is stated that by applying Problem Based Learning (PBL) learning the following things are obtained:

1) Students' ability to write symbols or mathematical notation has improved.
2) Students begin to get used to writing answers with a systematic process.
3) Students have started to be confident in conveying their ideas. Even students dare to speak, asking questions that are not yet known.
4) Students are getting used to writing information from a problem.
5) Students begin to be able to make written conclusions using so... By using their own words.
6) Students can use terms, mathematical notations.
7) Students begin to be able to associate story questions with other learning material.

From the results of the above reflection, this researcher has fulfilled success; the researcher is considered sufficient so that mathematics learning by applying Problem Based Learning (PBL) is sufficient in cycle II.

This means that the criteria for the nonverbal communication skills test of students fall into the high category; this shows that the average indicator of achievement increases, so the research is considered complete. The study results indicate an increase in students' nonverbal mathematical communication skills by applying Problem Based Learning (PBL) to class students VII B Yogyakarta Middle School 9 Yogyakarta Academic Year 2016/2017 even semester.

CONCLUSION

Based on the results of research and discussion, it can be concluded that the application of PBL learning models in mathematics learning can improve nonverbal communication skills of class VII B students of SMP Negeri 9 Yogyakarta. This is indicated by the increasing aspects of the communication of mathematics as follows:

1. An increase in students' nonverbal mathematical communication skills in the mathematics learning process. Based on the results of non-verbal communication skills training, students have improved mathematics. The average percentage of students 'nonverbal mathematical communication skills in the first cycle was 65.32%. The average percentage of students' nonverbal mathematical communication skills in the second cycle was 91.80% with a very high category.
2. From the interview results in students feel happy and enthusiastic about the application of Problem Based Learning (PBL), feel more motivated to understand learning during learning, and get a positive response from the teacher.

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